

## **Do I Really Have to Do Experiments?**

*Dr. Jay Wile*

### **Qualifications**

- University Professor From 1990 - 1995
- As a university professor, helped develop Indiana's Only Residential High School for Gifted and Talented Students
- NSF-Sponsored Scientist with More Than \$200,000 In Research Grants
- Became Interested in Homeschooling Because of Excellent University Students Who Were Homeschooled
- Currently writes homeschooling courses and is an adjunct professor at Anderson University

### **Here's What You Are Told About Science Education**

“...scientific learning that takes place in classrooms alone is not true learning. For fostering scientific learning in early childhood, active, hands-on learning is very important. And this can best be achieved through science lab experiments.” -Jennie Jenkins, science educator

[\(http://sciencefirst.com/ignite-science-kids-and-science-articles/science-lab-experiments-understanding-their-role-in-childhood-education/\)](http://sciencefirst.com/ignite-science-kids-and-science-articles/science-lab-experiments-understanding-their-role-in-childhood-education/)

In an international conference on science education, Maïke Tesch and Reinders Duit stated, “The experiment plays a key role in teaching science. Science instruction without any experiment is hardly conceivable.”

(Reinders Duit & Maïke Tesch, "On the role of the experiment in science teaching and learning – Visions and the reality of instructional practice," M. Kalogiannakis, D. Stavrou & P. Michaelidis (Eds.), *Proceedings of the 7th International Conference on Hands-on Science*, 25-31 July 2010)

### **While This is a Common Theme Throughout the World of Science Education, It is FALSE!**

Ernst Rutherford taught us what the atom looks like (a nucleus that is orbited by electrons). He never saw a lab until he petitioned his university to use a cloakroom so that he could do some experiments.

In fact, many of the great scientists who brought us the science we know today never saw a lab during their formal education, unless they pursued an advanced degree.

In addition, many of the famous scientists of the late 19<sup>th</sup> and early 20<sup>th</sup> centuries did not allow undergraduates into their labs!

The idea that experiments are a necessary part of science education is a relatively new concept.

## Why Do Science Educators Think Experiments are Important?

1. Scientists do experiments, so students have to learn how to do them.

But most students won't become scientists.

More importantly, educational labs **are nothing like real scientific experiments!**

2. We learned science by experiment, so students should learn it that way, too.

It took us more than 2,000 years to learn science that way. Most students don't have that kind of time.

3. Experiments teach scientific reasoning.

That's very true, but you can learn scientific reasoning by reading about others doing experiments and seeing how they arrived at their conclusions.

4. Experiments allow students to experience the joy of discovery

That's true, but the experiments have to be carefully monitored for safety, and the student usually has to be coached into the discovery.

5. Experiments add a "wow factor" that makes science fun and interesting.

That's true, **when they work.**

In addition, science itself is so utterly amazing that you don't need experiments for the "wow factor."

## What Are the Real Benefits of Doing Experiments?

1. They provide visuals that can help students picture a concept which might be hard to grasp. Not only can the visuals help the student grasp a concept, they can help the student retain the concept in his or her mind.

2. They can help the student learn good lab technique and lab safety. This can be especially beneficial in the high school years, so the students can be better prepared to use instruments properly, regardless of whether or not they are scientific instruments.

3. They can add a real "wow factor" to science education...when they work. This can enhance the learning, but only if it is done properly. If students see a "cool effect" and it is just explained to them, they often forget. They need to be led through the reasoning.

4. Universities want to see three science courses in high school, at least two of which are lab-based. Honestly, if the student is science oriented, this might be the most important benefit. Some students don't enjoy labs, and some "grow out" of them. However, they are needed for university.

## A Realistic View of Educational Experiments

In general, experiments are most effective when the students are young.

- 👉 Elementary science isn't content specific, so you can spend time on experiments...if that's what the students like.
- 👉 Basic concepts are more easily illustrated by experiments, and those kinds of experiments are more likely to work.
- 👉 Younger students are more easily "wowed."

Don't force experiments on students who don't want to do them, with the exception of university-bound students. In that case, force them to do two high school courses with a lab component. But please note that the labs don't have to be a part of the curriculum. The student can do book work throughout the year and then do a summer lab camp. The key is 25 hours of lab work are required to make it a high school lab.

### Resources That Will Help You

#### Elementary Level:

Janice Van Cleave's "\_\_\_\_\_ for Every Kid."

<http://www.amazon.com/Janice-VanCleave-Biology-Every-Kid/dp/0471503819>

Many of her books are found in the local public library.

Developing Critical Thinking Through Science

<http://www.criticalthinking.com> 1-800-458-4849

#### Elementary curriculum:

My elementary series published by Berean Builders. Lots of experiments, less reading.

[www.bereanbuilders.com](http://www.bereanbuilders.com)

Apologia's elementary curriculum. Less experiments than mine, more reading.

[www.apologia.com](http://www.apologia.com)

"God's Design For" curriculum. The fewest experiments in lab-based elementary curriculum.

[answersingenesis.org/](http://answersingenesis.org/)

#### Junior High curriculum:

Apologia's elementary curriculum. Lots of reading and several experiments.

[www.apologia.com](http://www.apologia.com)

"The Rainbow" curriculum. More experiments and less reading than Apologia.

[www.beginningspublishing.com](http://www.beginningspublishing.com)

## High School curriculum:

Not surprisingly, I like the stuff I wrote.

[www.bereanbuilders.com](http://www.bereanbuilders.com)

The “In Your Home” series. Fewer experiments than mine, but enough for high school. More of a research-based curriculum.

[www.scienceforhighschool.com](http://www.scienceforhighschool.com)

## Check the websites of local colleges and universities.

The university where I teach has STEM summer camps:

<https://www.anderson.edu/summer-camps/stem>

UCF has summer camps:

<http://siucf.cs.ucf.edu>

## A Note About “Writing Up” Labs

I do not think a lot of emphasis should be placed on formal lab reports. I don’t find them very useful.

If you want your child to do them, here are some places you can find guidelines:

<http://donmayoung.org/apologia/lab.htm>

<http://www-lhs.beth.k12.pa.us/departments/science/Science%20Department%20Lab%20Report%20Format.pdf>

<https://www.hopkinton.k12.ma.us/Page/5064>

## Here’s What’s Really Important for High School

Make sure your student keeps a **RECORD** of the lab **in his or her own handwriting**. This includes:

- The data (which might just be a description of what was seen)
- Any calculations that were done
- At least a brief description of what was done and what was learned.

This will be your proof of two lab-based high school courses.